6. (Twice Amended) A method as claimed in claim 4 wherein the step of moulding the former includes moulding a groove in the former; and wherein the step of disposing the at least one conductor around the curved former comprises winding the at least one conductor into the groove.

12. (Amended) A method of manufacturing a coil for a magnet the method comprising the steps of:

manufacturing a former from a resilient material to form a resilient former; and

disposing a hard-wire electrical conductor around the resilient former.

Remarks

The title and abstract of the disclosure have been amended. Also, the specification has been amended to include headings. It is believed that the amendments resolve any objections to the form of the specification. Request is hereby made for the Examiner's approval of same.

Claims 1, 6 and 12 have been amended. Separately attached hereto is Appendix A, showing another version of the rewritten claims, marked up to show all the changes relative to the previous version of the claims.

Claim Rejections - 35 USC 102(b) and 103

Claims 1-3, 5, 12, 13 and 15 have been rejected under 35 USC 102(b) as being anticipated by Weatherly (European Patent Publication 153,131). Claims 1-3, 5, 12, 13 and 15 have been rejected under 35 USC 102(b) as being anticipated by Dachniwskyj et al. (U.S. Patent No. 5,570,021). Claims 4, 14 and 16 have been rejected under 35 USC 103(a) as being unpatentable over EP 153,131 in view of Buckley (U.S. Patent No. 4,541,171). Claim 6 has been rejected under 35 USC 103(a) as being unpatentable over EP 153,131 in view of Messick et al. (U.S. Patent No. 5,926,945)

The present invention is related to a method of manufacturing a magnet coil in which hard-wire electrical conductors are wound around a former (in contrast to manufacture of a magnet that utilizes printed conductors of the type disclosed in EP 153,131). The invention particularly relates to the method of manufacture of the former.

In a preferred embodiment of the invention, the hard-wire electrical conductors are disposed in grooves provided in the former.

The application as filed clearly indicates that the electrical conductor of the magnet coil is a hard-wire conductor. This is shown by the references to the references to "copper wire or copper bar" at page 4, line 8 of the application; both copper wire and copper bar are a hard-wire electrical conductor. Although this passage relates to the description of the prior art, it is clear that the application addresses problems associated with the prior art methods of fabricating such a magnet. Thus, this passage will also apply to a magnet coil manufactured by a method of the invention. Furthermore, Figure 4 of the application clearly shows that the conductor (42) of the magnet is a conductive bar, and this is a hard-wire electrical conductor.

Independent claim 1 has been amended to specify that the electrical conductor is a hard-wire electrical conductor. Claim 1 now recites a method of manufacturing a coil for a magnet comprising: providing a curved former; and disposing at least one hard-wire electrical conductor around the curved former. The step of providing the curved former comprises the steps of manufacturing a former in a flat or substantially flat shape to form a flat shape former; and bending the flat shape former into a curved shape to form the curved former.

EP 153,131 relates to a magnet that has a printed conductor rather than a hard-wire conductor. For example, the opening words of the abstract of EP 153,131 clearly indicate that in this disclosure the electrical conductor "is printed onto a flexible sheet." The description of the preferred embodiment starting at page 2, line 13 also clearly indicates that the coil is defined by printing a conductive pattern onto a flexible sheet or substrate (12). As Figure 1 shows, the coil is printed onto the substrate when it is flat. Once the conductive pattern has been printed on the substrate, the substrate is curved, for example, into a cylinder as shown in Figure 2.

In the present invention, in contrast, a flat former is provided, and this is bent into a curved shape. Once the former has been bent into a curved shape, the electrical conductor is disposed around the curved former. Accordingly, the rejection of claim 1 as not novel over EP 153,131 is incorrect, since this citation does not disclose the step

of disposing an electrical conductor around the curved former - in the citation the conductor is printed onto a flat substrate and the substrate is then curved.

Furthermore, the amended claim 1 contains a further novel feature over EP 153,131, which is that the conductor is a hard-wire electrical conductor. The citation discloses only the use of printed conductors, and does not relate to the manufacture of a magnet coil that has a hard-wire electrical conductor. The technical field of magnets having hard-wire electrical conductors is quite distinct from the field of magnets having printed circuit conductors.

US 5,570,021 does not relate to the manufacture of a magnet coil. Instead, it addresses the problem of maintaining two magnet coils (the inner coil 12 and the inner coil 14) in a fixed and accurately determined relationship to one another. The citation is directed to providing a "stiffening cylinder" (16) between the inner and outer magnet coils, to provide increased structural strength of the combined coil assembly. This is clear from, for example, column 1, line 52 to column 2, line 41.

This citation does not relate to the method by which the individual magnet coils are manufactured, and the manufacture of the coils is therefore described only very briefly. Column 4, lines 29-36 simply state that the Z-gradient coil set is manufactured by winding a wire or like conductor 36 around the outer circumference of a coil form 34 (the coil form 34 corresponds to the former of the application). However, there is no description at all as to how the coil form is manufactured, which indicates that the method of manufacture of the form would be entirely conventional. Thus, the manufacture of the Z-gradient coil set of the inner and outer coil assemblies 12, 14 will suffer from the disadvantages described at pages 3 and 4 of the present invention. This problem is not addressed in US 5,570,021, which does not relate to the manufacture of the individual magnet coils.

It can therefore be seen that US 5,570,021 contains no disclosure or suggestion that the coil form 34 could be initially manufactured in a flat or substantially flat shape, and then bent into a curved shape. There is no teaching at all in this citation of the manufacturing method of the present invention and, indeed, this citation does not relate to a method of manufacturing individual magnet coils.

It is accordingly believed that the amended claim 1 is novel and inventive over EP 153,131 and US 5,570,021.

For at least the foregoing reasons, it is respectfully submitted that the rejection of claim 1 be withdrawn and that the claim be allowed. Also, claims 2-6, which depend either directly or indirectly from claim 1, should also be allowed for at least the same reasons.

Independent claim 12 has been amended in the same manner as claim 1, and now specifies that the conductor is a hard-wire electrical conductor. Claim 12 now recites a method of manufacturing a coil for a magnet the method comprising the steps of manufacturing a former from a resilient material to form a resilient former; and disposing a hard-wire electrical conductor around the resilient former.

As is set out in the introduction to the present application, a conventional magnet coil that has a hard-wire electrical conductor is manufactured by winding the conductor around an insulating former formed of fibreglass. Fibreglass is not a resilient material, so that disposing the conductor directly on the fibreglass former would produce an unacceptably high level of noise when the magnet was energised. In the prior art, therefore, it is necessary to line the former with a resilient material, such as a rubber sheet, to act as a shock absorber and damp vibrations of the electrical conductors in order to reduce the generation of noise.

According to the aspect of the invention defined in claim 12, the former is manufactured from a resilient material. This avoids the need for the prior art step of lining a former (made of a non-resilient material) with a resilient material before winding the magnet coil around the former. The Examiner has not explained the basis for the novelty objections. It is not seen where the Examiner considers that the use of a resilient former is disclosed in EP 153,131 or US 5,570,021. Neither of the citations discloses a method manufacturing a former from a resilient material.

EP 153,131 relates to a magnet coil in which the electrical conductor is printed onto a flexible sheet. Since the conductor is printed onto the substrate, it cannot move relative to the substrate, so that the particular problem discussed at page 4, lines 12-18 of the application does not apply to this citation (nor indeed to coils having a printed conductor in general).

Moreover, this citation does not disclose the step of manufacturing a former from a resilient material - it uses a fibreglass substrate, but fibreglass is not a resilient material. The substrate is clearly flexible, since it can be curved, but the fact that the former is flexible (that is, will bend without breaking) does not mean that it is necessarily resilient (will revert to its original shape if a deforming force is removed).

Furthermore, as discussed previously, this citation does not disclose the step of disposing a hard-wire electrical conductor around the former, but relates to the different technical filed of magnets that use printed conductors.

In US 5,570,021, the electrical conductor 36 of the Z-gradient coil is disposed onto a fibreglass form. Thus, the method of manufacturing the coil form is entirely conventional, and is generally similar to that acknowledged at pages 4, lines 4-11 of the present application. This citation does not disclose the step of manufacturing a former from a resilient material, and disposing a hard-wire electrical conductor around the resilient former.

US 5,570,021 does not address the problem of magnet noise but, as explained above, instead addresses the problem of keeping the inner and outer coil assemblies accurately positioned relative to one another. Thus, this citation does not provide any teaching that is relevant to the present invention.

For at least the foregoing reasons, it is respectfully submitted that the rejection of claim 12 be withdrawn and that the claim be allowed. Also, claims 13-16, which depend either directly or indirectly from claim 12, should also be allowed for at least the same reasons.

US 4,541,171 does not cure the deficiency of EP 153,131; that is, it does not disclose, teach or suggest disposing a hard-wire electrical conductor around a curved former, wherein the curved former is provided by manufacturing a former in a flat or substantially flat shape to form a flat shape former, and bending the flat shape former into a curved shape to form the curved former. Thus, for at least this reason and the reasons set forth in regard to claims 1 and 12, it is respectfully submitted that the rejection of claims 4, 14 and 16 be withdrawn and that the claims be allowed.

Dependent claim 3 recites that the former is manufactured from a resilient material. As discussed above in regard to claim 12, the cited art does not disclose, teach or suggest manufacture of the former from a resilient material.

Also, claim 6 has been amended to depend from claim 4 and to specify that the groove in the former is formed during the step of moulding the former. Claim 6 now recites that the step of moulding the former includes moulding a groove in the former; and the step of disposing the at least one conductor around the curved former comprises winding the at least one conductor into the groove.

The Examiner contends that it would have been obvious to have incorporated the groove disclosed in the U.S. Patent No. 5,926,945 into the former of EP 153,131. For the reasons that follow, it is respectfully submitted that this rejection is incorrect. As noted above, EP 153,131 relates to a method in which a magnet is manufactured by printing a conductive pattern on to a flat substrate. The substrate is then bent into a curved shape to form a magnet coil. In contrast, US 5,926,945 relates to a method of manufacturing a coil by winding heat-bondable wire around a grooved former. These are completely different technologies, and a skilled person would not have considered combining them in the manner alleged by the Examiner in paragraph 14 of the Office Action.

In the method of US 5,926,945, a heat-bondable wire is wound into a groove in a former. When the coil has been wound, it is heated to cause the heat-bondable wire to fuse to form a solid coil. The groove in the former is provided to ensure that the resultant coil has the desired dimensions.

In EP 153,131, however, a magnet coil is manufactured by printing a conductive pattern onto a flat substrate. The dimensions of the conductive pattern will be determined by the dimensions of the printing plate used to print the conductive pattern.

A skilled person would not have considered combining EP 153,131 and US 5,926,945 in the manner suggested by the examiner. The groove in the former of US 5,926,945 is provided to ensure that the coil is wound to the desired dimensions - but in EP 153,131 the dimensions of the conductive pattern are determined by the dimensions of the printing plate used to print the conductive pattern and there is no need to provide grooves for this purpose. Indeed, a skilled person would have realised that the method

of EP 153,131 requires a flat substrate - if the substrate contained grooves, the printing operation could not be carried out reliably as there would be risk that the grooves would cause gaps in the printed coil pattern.

Conclusion

The claims are believed to be allowable and the application is believed to be in condition for allowance. Prompt indication of same is earnestly solicited. If the Examiner does not believe that the above amendments place the application in condition for allowance, the Examiner is respectfully requested to telephone the undersigned to resolve any outstanding issues.

Should a petition for an Extension of Time be necessary for the timely reply to the outstanding Office Action (or if such a petition has been made and an additional extension is necessary) petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988 under Attorney Docket No. MARSP0114US.

Respectfully Submitted,
RENNER, OTTO, BOISSELLE & SKLAR

By _____
Paul R. Steffes
Reg. No. 43,156

1621 Euclid Avenue, 19th Floor
Cleveland, Ohio 44115-2191
(216) 621-1113
H:\106\Prs\Mars\P0114\OAResp7-19-00.wpd

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence (along with any paper referenced as being attached or enclosed) is being deposited on the date shown below with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Dated: 12/13/08

_____
Amanda L. Amato

APPENDIX A

1. (Amended) A method of manufacturing a coil for a magnet comprising:

providing a curved former; and

disposing at least one hard-wire [an] electrical conductor around the curved former;

wherein the step of providing the curved former comprises the steps of:

a) manufacturing a [the] former in a flat or substantially flat shape to form a flat shape former; and

b) bending the flat shape former into a curved shape to form the curved former.

6. (Twice Amended) A method as claimed in claim 4 [1] wherein the step of moulding the former includes moulding a groove in the former; and wherein the step of disposing the at least one conductor around the curved former comprises winding the at least one conductor into the groove [former comprises a groove and the electrical conductor is disposed in the groove].

12. (Amended) A method of manufacturing a coil for a magnet the method comprising the steps of:

manufacturing a former from a resilient material to form a resilient former; and

disposing a hard-wire electrical conductor around the resilient former [comprising the step of disposing an electrical conductor around a resilient former].

H:\106\Prs\Mars\P0114\OAResp7-19-00.wpd